

# UPS Webinar: Draft Test Procedure Review 11-19-10

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# Outline

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1. Introduction
  - Meeting objectives
  - Background
2. UPS Test Procedure Review
3. What's Next?
4. General Comments
5. Contacts and Resources

# Introduction: Meeting Objectives

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1. Feedback on draft test procedure
2. Examine specification development timeline
3. Take general comments or concerns relevant to UPS spec development

# Introduction: Why ENERGY STAR?



- UPS Energy Savings Potential is High
  - 550 to 710 million kWh/year in the US
  - Majority in small capacity devices
  - But per-unit savings greater in high capacity
- Data center energy demands increasing
  - Double every ~5 years
  - UPS critical for efficiency
- Potential for Cost Savings
  - Approximately 2 – 3 years ROI
  - Varies by product size

# Introduction: Why ENERGY STAR (cont'd)



- Pre-existing efficiency trend
  - Customer demand drives efficiency
  - ENERGY STAR can help:

## Introduce Uniformity

- UPS efficiency testing, reporting
- Aid customers in comparisons

## Performance vs. Efficiency

- Help datacenter customers make tradeoffs
- Possibly develop sizing guidance



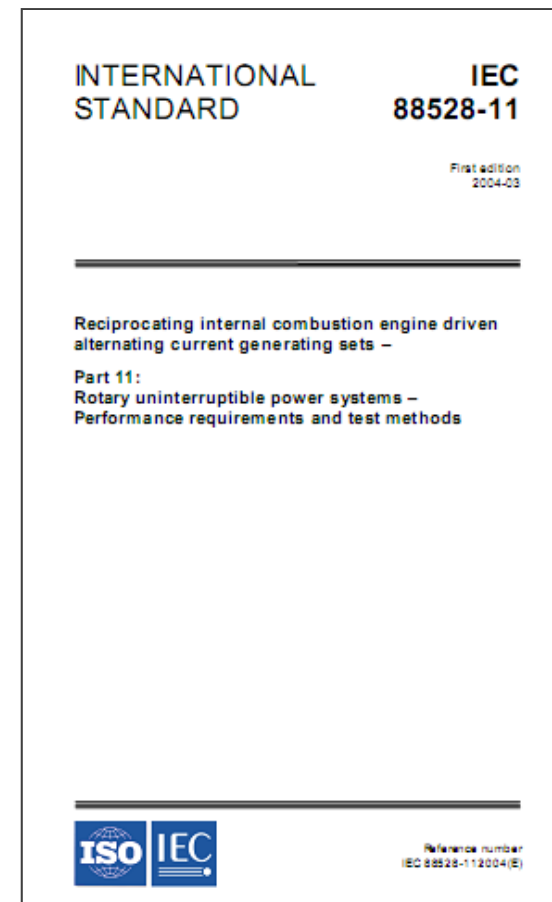
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# UPS Test Procedure Review

# ENERGY STAR UPS Draft Test Method: Overview



- Based on Int'l Electrotechnical Commission (IEC) Standards
  - **IEC standard 62040-3.** “Uninterruptible power systems (UPS) - Part 3: Method of specifying the performance and test requirements.” Ed. 2.0 Committee Draft for Vote (CDV).
  - **IEC standard 88528-11.** “Reciprocating internal combustion engine driven alternating current generating sets—Part 11: Rotary uninterruptible power systems—Performance requirements and test methods.” Ed. 1.0.



# ENERGY STAR UPS Draft Test Method: Overview (cont'd)



- Use to assemble a dataset in support of a future ENERGY STAR specification for UPS
  - Dataset assembly for 8 weeks: from Dec. 2010 to Feb. 2011
  - Test method may be revised before use for qualification

EPA welcomes comment on the test method from both perspectives:

- Making comparisons between models for specification development
- Clearly addressing full range of UPSs for qualification



# ENERGY STAR UPS Draft Test Method: Applicability



- Eligible Products:
  - Single-phase and three-phase UPS for home, office, and datacenter use
  - Static and Rotary UPSs
  - AC-output and DC-output UPSs
- Intended to provide a complete assessment of UPS efficiency during typical use with an IT load



# DOE Battery Charger Test Method



- The U.S. Department of Energy (DOE) recently proposed a test method for battery chargers.
  - To evaluate energy savings for battery charging component of consumer UPSs.
  - Measures energy consumption during charging and maintenance (float) modes of charger, with no load connected.
- EPA is proposing to use its draft test method (based on IEC 62040-3) to evaluate UPS energy consumption
  - Takes into account normal mode, loading, etc.

EPA welcomes comments on this proposal.

# ENERGY STAR UPS Draft Test Method: Definitions



- Definitions sourced from:
  - Draft IEC 62040-3 Ed. 2.0
  - Stakeholder comments
  - IEC 88528-11
  - Framework Document
- Definitions divided into several sections:
  - Product Types
  - Operational Modes
  - Power
  - Redundancy
  - Topologies
  - Other

# ENERGY STAR UPS Draft Test Method: Definitions (cont'd)



- Energy Saver Mode (such as “Eco-Mode”)
  - Energy Saver modes meet the definition of Normal Mode in IEC 62040-3 Ed. 2.0.
  - EPA proposes to compare efficiency in each mode that meets the definition, including Energy Saver modes.

EPA welcomes comments on this proposal.

# ENERGY STAR UPS Draft Test Method: Definitions (cont'd)



- UPS Topologies and Types (static versus rotary)
  - Only used to classify UPSs during data analysis.
  - EPA intends to use technology-agnostic approach.
- Topologies not listed are considered subtypes of the listed topologies.
  - E.g., “delta-conversion” considered line-interactive

EPA welcomes comments on this proposal.

# ENERGY STAR UPS Draft Test Method: Definitions (cont'd)



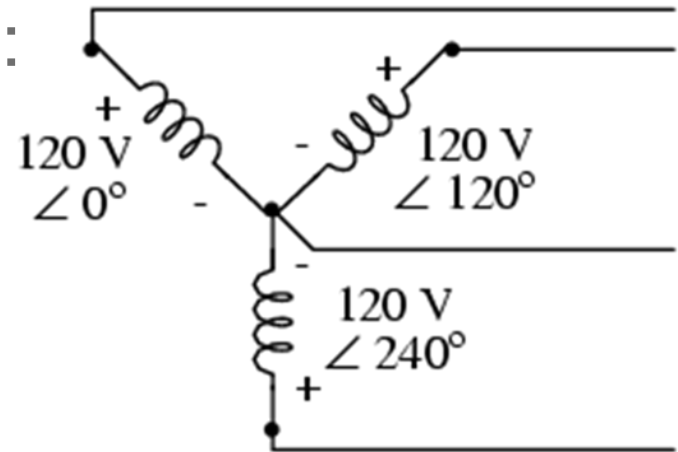
- Unit Under Test
  - Includes not only UPS, but also any accessories to meet test voltage conditions.
  - Establishes a common set of output and input characteristics to enable comparisons between models.

EPA welcomes comments on this proposal.

# ENERGY STAR UPS Draft Test Method: Test Setup



- EPA proposes to categorize UPSs by number of phases:
  - Consumer/small office
  - Datacenter UPSs
- Alternatively, EPA is also considering using output power (per IEC 62040-3)



EPA welcomes comments on this proposal.

# ENERGY STAR UPS Draft Test Method: Test Setup (cont'd)



- Input Power Requirements Single-Phase

| Market                         | Voltage | Voltage Tolerance | THD   | Freq.          | Freq. Tolerance |
|--------------------------------|---------|-------------------|-------|----------------|-----------------|
| North America, Taiwan          | 115 VAC | +/- 1.0 %         | 2.0 % | 60 Hz          | +/- 1.0 %       |
| Europe, Australia, New Zealand | 230 VAC | +/- 1.0 %         | 2.0 % | 50 Hz          | +/- 1.0 %       |
| Japan                          | 100 VAC | +/- 1.0 %         | 2.0 % | 50Hz/<br>60 Hz | +/- 1.0 %       |

- And Three-Phase products

| Market                       | Voltage     | Voltage Tolerance | THD   | Freq. | Freq. Tolerance |
|------------------------------|-------------|-------------------|-------|-------|-----------------|
| North America, Taiwan        | 277/480 VAC | +/- 4.0 %         | 5.0 % | 60 Hz | +/- 1.0 %       |
| Europe, Australia, NZ, Japan | 230/400 VAC | +/- 4.0 %         | 5.0 % | 50Hz  | +/- 1.0 %       |



# ENERGY STAR UPS Draft Test Method: Test Setup (cont'd)



- Typical UPS operating voltages
  - European output voltage proposed for three-phase UPS testing to promote more efficient operation.
  - Input or output accessories should be used with UPSs not designed to meet the specified conditions.

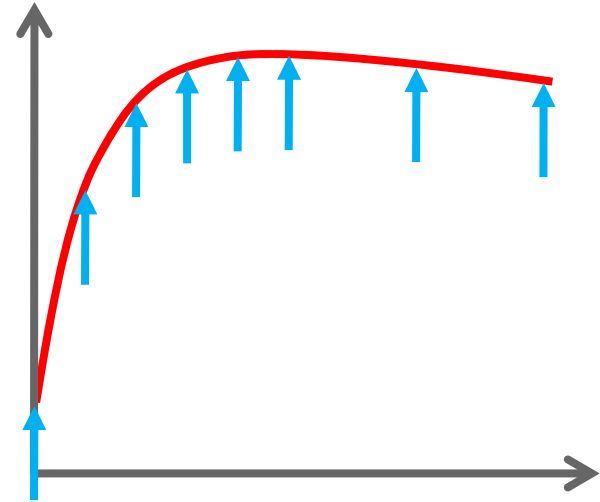
This is in contrast with IEC 62040-3 and some stakeholder comments, which suggest testing at the UPS design input voltage. EPA welcomes comment on the pros and cons of this approach.

- DC-Output UPSs
  - Same input voltage as AC UPSs
  - 380 VDC output

# ENERGY STAR UPS Draft Test Method: Efficiency Test



- Proposed Loading Points:
  - Test at 100%, 75%, 50%, 40%, 30%, 20%, 10%, and 0% of the reference test load.



- Differ from IEC 62040-3 and data collected to date (at 100%, 75%, 50%, and 25% of load).

EPA welcomes comment on whether the proposed test conditions allow for an assessment of the practical efficiency range.

# ENERGY STAR UPS Draft Test Method: Efficiency Test (cont'd)



- Measurement at 0% intended to limit energy losses due to underutilized UPSs.
  - Maintain chemical batteries with the output inverter turned off, in a “standby” or “hibernate” mode.
  - Also, limit battery maintenance losses.

EPA welcomes comment on the best way to test that batteries are being maintained in this mode. For example:

- Monitoring the status display of the UPS,
- Momentarily connecting the batteries to measure current, or
- Momentarily connecting a test load to mimic the batteries.

# ENERGY STAR UPS Draft Test Method: Efficiency Test (cont'd)



- The efficiency test shall be repeated in case of:
  - **Energy Saver Modes:** repeated for each mode that meets definition of Normal Mode.
  - **Parallel EPSs with Scalable Output Power:** repeated at min. and max. configurations.

EPA welcomes comment whether repeating the efficiency tests as described above allows for comparisons:

- Between desired efficiency and reliability, and
- Between performance of parallel and non-parallel units.

# ENERGY STAR UPS Draft Test Method: Overload Test



- Measuring Time in Overload
  - Overload handling allows a facility manager to use a UPS closer to 100% load where the efficiency is highest.
  - Proposed overload test based on section 6.4.2.10.1 of IEC 62040-3: Testing of manufacturer's overload claims.
  - Test at 125%, 150%, 200% of the reference test load and any other conditions desired.

EPA welcomes comment on the benefits of overload testing and performing such tests safely.



# Dataset Parameters

- Proposed Parameters Include:
  - Electrical input and output characteristics
  - Characteristics of energy storage device
  - Energy efficiency
  - Other general characteristics

EPA welcomes comment on striking the right balance between

- Imposing minimal burden, and
- Assembling the data necessary to make effective comparisons and set an energy efficiency specification.

# Dataset Parameters (cont'd)

- Stakeholders commented that testing is burdensome, and that some data (tested to initial version of IEC 62040-3) already exists
  - EPA will collaborate with stakeholders to build a large dataset.
  - EPA encourages stakeholders to both:

- Generate new data in accordance with final Data Input Form (to be released in December).
- Submit existing data, even if generated under different loading points/conditions (using provided data input form).

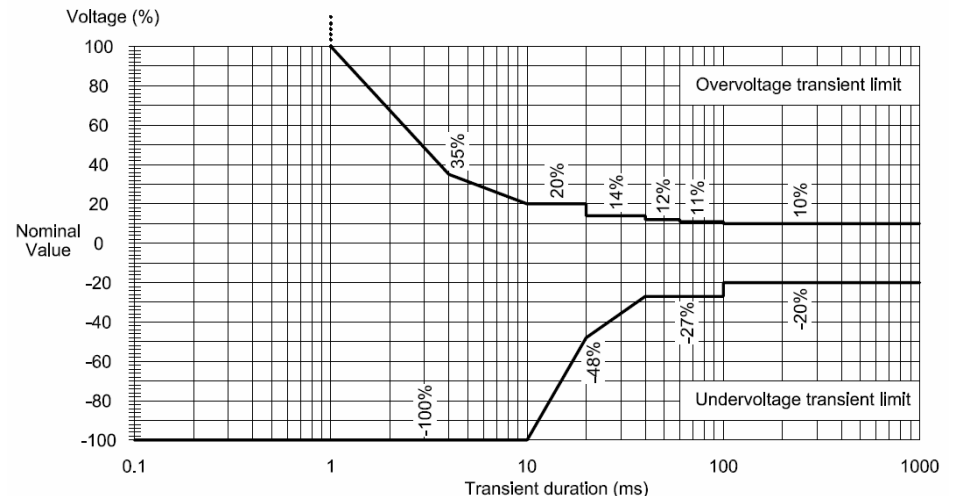


# Dataset Parameters (cont'd)



- Output conditioning characterized using the metrics in IEC 62040-3:
  - Voltage and frequency dependence (VFI, VI, VFD)
  - Voltage waveform characteristic (sinusoidal: yes/no)
  - Dynamic output performance (similar to of ITI-CBEMA curve).

EPA welcomes comment on whether this characterization sufficiently captures users' performance concerns.



# Data Input: Additional Environmental Considerations



- EPA also seeks to identify efficient UPSs that deliver additional environmental benefits:
  - Battery recycling
  - Longer lifetimes through maintenance/warranties
  - Lower air-conditioning burden
- Some stakeholders have commented that these benefits should not/need not be accounted for in an ENERGY STAR specification.
  - E.g., IEC 62040-4, under development, deals with these issues.

EPA welcomes input on additional environmental considerations and how best to address them.

# Real-Time Power Measurement and Reporting



- EPA is interested in real-time reporting for all datacenter products.
  - Stakeholders have commented that parallel efforts are currently under way.
  - E.g., Modbus, SNMP

EPA welcomes input on how it can best:

- Promote an industry-standard real-time reporting protocol, or
- Use the ENERGY STAR specification to standardize divergent protocols.

# What's Next?



- Refine test procedure
- Develop Power Performance Data Sheet (PPDS) and Real-Time Power Measurement and Reporting
- Coordinate education
  - Data center operators, purchasing authorities
  - Encourage adoption of more efficient systems, practices
- Use data to understand UPS market
  - Energy consumption of small, medium, large systems
  - Quantify tradeoffs between reliability and efficiency
  - Performance, hardware characteristics
  - Special features
    - kWh reporting, Eco-Mode, overload, etc.

# What's Next? (cont'd)

- December:
  - Receive feedback on test procedure (12/8/10)
  - Publish final test procedure (12/17/10)
  - Begin dataset development
- February :
  - Finish dataset development (2/4/11)
  - Begin spec draft process
- March – June:
  - Draft revisions
  - Stakeholder input/meetings
- July:
  - Publish final specification (7/15/11)
  - Effective immediately

2011 Dates  
are Tentative

# Open Comment

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- EPA would now like to open up the line for any general comments from stakeholders.



# References and Resources

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- Energy Star UPS specification development  
[http://www.energystar.gov/index.cfm?c=new\\_specs.uninterruptible\\_power\\_supplies](http://www.energystar.gov/index.cfm?c=new_specs.uninterruptible_power_supplies)
- Energy Star Data Center energy efficiency initiatives  
[http://www.energystar.gov/index.cfm?c=prod\\_development.server\\_efficiency](http://www.energystar.gov/index.cfm?c=prod_development.server_efficiency)



# Thank You!

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